CLAIMS

What is claimed is:

1. A method for connecting a solder bump of an array of solder bumps on a semiconductor device and a contact site of a plurality of conductive contact sites of a member, comprising:

heating said solder bump of said array of solder bumps to a softening temperature Ts below a melting temperature of said solder bump of said array of solder bumps; and

contacting said contact site of said plurality of conductive contact sites by said solder bump of said array of solder bumps of said semiconductor device using a pressure less than substantially 22 grams-force for said solder bump and another solder bump of said array of solder bumps.

2. The method of claim 1, wherein said melting temperature of said array of solder bumps is T degrees Centigrade higher than an ambient temperature To, and wherein said softening temperature Ts is in the range of about 0.5T to 0.95T above said ambient temperature To.

3. The method of claim 1, wherein said solder bump of said array of solder bumps contacts said contact site of said plurality of conductive contact sites at a pressure not substantially exceeding about 10 grams-force.

4. The method of claim 1, wherein said solder bump of said array of solder bumps contacts said plurality of conductive contact sites at a pressure of in the range of about 2 to 10 grams-force.

5. The method of claim 1, wherein said semiconductor device having said array of solder bumps is heated by one of hot air convection and infrared radiation.

6. The method of claim 1, wherein said member having said plurality of contact sites is heated by one of hot air convection, conduction from a heated object, and infrared radiation.

7. The method of claim 1, wherein said semiconductor device and said member are placed in a temperature-controlled oven for heating to said softening temperature Ts.

8. The method of claim 1, wherein said semiconductor device is held in a chuck, said chuck being heated.

9. The method of claim 1, wherein member is held in a chuck, said chuck being heated.

10. The method of claim 1, wherein said member having said plurality of conductive contact sites is heated by electrical resistance wires.

11. The method of claim 1, wherein said member and a substrate are mounted on a mounting board having an integral heater, said integral heater controlled to heat said member to said softening temperature Ts.

12. The method of claim 1, wherein said array of solder bumps comprises Sn-Pb solder having a lead content in the range of about 40 to about 98 percent, and said softening temperature Ts comprises a range of about 140 to 180 degrees C.

13. The method of claim 1, wherein said heating comprises predetermining a heating time X to heat said solder bump of said array of solder bumps to said softening temperature Ts, and heating for said time X.

14. The method of claim 1, wherein said heating comprises initiating said heating, measuring a temperature of one of a member and a semiconductor die being heated, and stopping said heating to limit the temperature of said solder bump of said array of solder bumps to no more than said softening temperature Ts.

15. An apparatus for connecting a solder ball to a contact site comprising:

a first member having a solder ball thereon;

a second member having a contact site;

apparatus for moving said first member against said second member for contact of said solder ball to said contact site, said first member contacting said second member at a pressure less than substantially 22 grams-force for said at least one solder ball; and

heating apparatus for heating said solder ball and said at least one contact site to a submelting solder softening temperature Ts.

16. The apparatus of claim 15, wherein said contact site comprises one of a substantially flat surface, a recess for receiving a portion of a solder ball, and a recess having at least one projection therein for deforming a solder ball inserted therein.

17. A testing apparatus for a semiconductor package having a ball grid array of solder balls on a surface thereof, said apparatus comprising:

an insert formed of generally noncompliant material, said insert having a first surface including an array of contact sites for contacting said ball grid array of solder balls, and having a second surface;

a substrate having a first surface, having a second surface, said second surface of said insert secured to said first surface of said substrate, and having a pattern of leads on said substrate for connecting to contact leads in a socket;

electrical leads connecting said array of contact sites of said insert with said pattern of leads of said substrate;

a test board having said socket with said contact leads connected to a testing circuit, said substrate and said insert for insertion into said socket for contact of said pattern of leads of said substrate with said contact leads of said socket; and

heating apparatus associated with at least one of said substrate, said insert, and said socket.

18. The apparatus of claim 17, further comprising temperature sensing apparatus attached to one of said substrate, said insert, and said semiconductor package.

19. The apparatus of claim 18, further comprising a temperature controller for controlling said heating apparatus.